



Comparative Packaging Study

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PURPOSE

- Evaluate new high barrier food packaging films for use on long duration space missions.
- Determine the effects of:
 - High temperatures during heat sealing
 - Stress cracking from folds in the films caused by vacuum packing
 - Relative humidity during storage

Deliverables

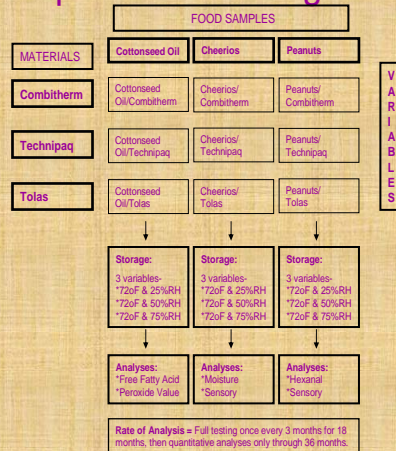
- Quantitatively evaluate each packaging material after final processing for oxygen and water vapor transmission through analysis of ingredients susceptible to moisture uptake and lipid oxidation.
- Qualitatively determine changes in food product attributes through sensory evaluation methods after storage in 3 different packaging films.
- Evaluate the potential of each packaging material based on qualitative and quantitative results.

Food Sample Selection

- Dry cereal is prone to reduced quality from absorption of water vapor.
- Cottonseed oil is susceptible to lipid oxidation in the presence of oxygen.
- Peanuts produce a rancidity marker, hexanal, which can be quantified by analysis of the gas in the headspace of the package.



Experimental Design Matrix



Permeation Rate Comparison

- The table below shows the oxygen transmission rate (OTR) and water vapor transmission rate (WVTR) for each packaging material listed.
- Glass and aluminum have the best available barrier properties for food packaging purposes.
- Temperature and relative humidity may have an effect on the permeation rate of a packaging film.

MATERIAL	OTR @ 73°F & 190% RH (grams/100in ² /day)	WVTR @ 100°F & 100% RH (grams/100in ² /day)
Combitherm	5-405	0.352
Technipaq	<0.0003	<0.0003
Tolas	<0.0030	<0.0003
Glass	<0.0003	<0.0003
Aluminum	<0.0003	<0.0003

Cheerios

- Tolas (AIOX Coated Film)
- Technipaq Film

- Peanuts in Combitherm
- Oil in Combitherm

Packaging Material Information

Combitherm Film

- Structure: Nylon/EVOH/Nylon/High Ethylene Vinyl Acetate Polyethylene/LLDPE
- PROS: Lightweight and transparent. Microwaveable and can be incinerated.
- CONS: Requires an overwrap film due to poor barrier properties. Overwrap causes a major increase in mass for food system.

Technipaq Film

- Structure: A quad laminate film. PET/Polyethylene/Aluminum/Ionomer
- PROS: Best barrier properties available in a film.
- CONS: Film cannot be incinerated or microwaved due to aluminum layer. Film is not clear to allow for food identification.

Tolas Film

- Structure: A PET film coated with a thin layer of aluminum oxide.
- PROS: Very lightweight with excellent barrier properties. Transparent film. Microwaveable and can be incinerated.
- CONS: Stress cracking caused by wrinkles during vacuum packing may reduce the barrier properties.